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Attorney Docket No. ECO530/4-2
Date February 9, 2000

From

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PATENT APPLICATION TRANSMITTAL LETTER

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Sir:
Transmitted herewith for filing under 37 C.F.R. 1.53(b) is a(n):
(X) Utility
(X) Original patent application,

Inventor(s): **Manjit S. Chowdhary and Walter M. White**
For: **IMPROVED HYDRATION OF GUAR GUM POWDER**

Enclosed are:

1. ☒ 20 pages of written description, claims and abstract.
2. ☒ 2 sheets of drawings.
3. ☒ Combined Declaration and Power of Attorney.
   (a) ☒ Newly executed (original or copy)
4. ☒ Assignment Papers (cover sheet and document(s)) of the invention to Economy Mud Products Company
5. ☒ A verified statement to establish small entity status under 37 CFR 1.9 and 37 CFR 1.27.
6. ☐ Information Disclosure Statement and Form PTO-1449. ☐ Copies of IDS Citations.
7. ☐ Preliminary Amendment
8. ☒ Return Receipt Postcard *(should be specifically itemized)*
9. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
10. ☐ Other: _____

Attorney Docket No. ECO530/4-2
Date February 9, 2000

11. **Utility Fee Calculation**

CLAIMS AS FILED				
		Entity		
	Fee for:	☒ Small	☐ Other	Amount
	Basic fee	$345.00	$690.00	$345.00
	Each independent claim in excess of 3	1x $39.00	x $78.00	39.00
	Each claim* in excess of 20	20 x $9.00	x $18.00	180.00
	Multiple dependent claim (one-time fee)	$130.00	$260.00	
	*Including the total number of claims to which direct reference is made in all multiple dependent claims		TOTAL FILING FEE	$564.00

Method of Fee Payment

14. ☒ A check in the amount of $564.00 to cover the filing fee is enclosed.

15. ☒ A check in the amount of $40.00 to cover the assignment recordal fee is enclosed.

16. ☐ Please charge my Deposit Account No. 22-0365 in the total amount of the filing fee and the assignment recordation fee, if any. A duplicate of this Transmittal Letter is enclosed.

17. ☒ The Commissioner is hereby authorized to charge any deficiency in the enclosed fees under 37 C.F.R. §1.16, or to charge any patent application processing fees under 37 C.F.R. §1.17, or credit any overpayment, to Vinson & Elkins L.L.P. Deposit Account No. 22-0365.

Stuart J. Ford
Reg. No. 37,486
Counsel for Applicant

Attorney Docket No. ECO530/4-2 *PATENT*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

☒ In re application of Applicant or Patentee: Manjit S. Chowdhary and Walter M. White

☐ Serial or Patent No.:

☐ Filed or Issued on:

Title: IMPROVED HYDRATION OF GUAR GUM POWDER

STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(b)--SMALL BUSINESS CONCERN

I hereby state that I am

☐ the owner of the small business concern identified below:

☒ an official of the small business concern empowered to act on behalf of the concern identified below:

Name of Small Business Concern	Economy Mud Products Company
Address of Small Business Concern	435 E. Anderson Road Houston, Texas 77047

I hereby state that the above identified small business concern qualifies as a small business concern, as defined in 13 CFR 121.12, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees to the United States Patent and Trademark Office under Sections 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third-party or parties controls or has the power to control both.

I hereby state that rights under contract or law have been conveyed to, and remain with, the small business concern identified above, with regard to the invention described in

☒ the specification filed herewith, with title as listed above.

☐ the application identified above.

☐ the patent identified above.

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights in the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c), if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each such person, concern or organization having any rights in the invention is listed below:

☒ No such person, concern, or organization exists.

☐ Each such person, concern or organization is listed below.

Name ____
Address ____

____

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small business entity is no longer appropriate. (37 CFR 1.28(b))

☒ I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Name of Person Signing: WALTER M. WHITE
Title of Person if Other Than Owner: VICE PRESIDENT
Address of Person Signing: 435 E. Anderson Road
Houston, Texas 77047

SIGNATURE: [signature]

Date: 02/03/2000

118939.1

IMPROVED HYDRATION OF GUAR GUM POWDER

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TECHNICAL FIELD OF THE INVENTION

This invention relates generally to a process of improving the hydration characteristics of guar gum powder, and more specifically to a method including the step of extruding guar gum splits prior to grinding same so as to enable such improved hydration characteristics.

BACKGROUND OF THE INVENTION

Guar gum comes from a plant that is grown primarily in India and Pakistan, although other climates are also friendly to its cultivation. Guar is a legume-type plant that produces a pod, much like a green bean. In the pod there are seeds that, upon heating, split open exposing the endosperm and meal. The resulting product is then differentially ground to purify the endosperm. Such purified endosperm is referred to a "split."

The exposed endosperm contains a polymer of great use for thickening industrial and commercial fluids. The polymer is a polysaccharide material known as polygalactomannan. This material develops a high viscosity via hydration of the fluid to be thickened, similar to the action of starch. The guar endosperm polymer is much more efficient than starch in developing viscosity, however.

Guar gum has numerous applications in the oil industry as an additive to drilling and fracturing fluids. Other industrial and commercial applications abound. For example, it is used in the explosives industry to thicken gelled explosives. It is used as a food additive as a thickener. It is used in paper manufacturing to increase the water-absorption and wet strength characteristics of paper. It is used in textiles in carpeting as part of the colorizing or shading process. Another use is in animal litter to enhance clumping characteristics. Further uses include synthetic fuel briquette manufacture, and in firefighting to deliver thickened water to smother fires.

Guar gum powder is known in the art to be manufactured primarily by flaking the hydrated splits, then grinding the flakes, and then drying the resulting powder. Just like any powder, guar gum's hydration characteristics are related to the particle size of the powder. The smaller the particles, generally the better the hydration characteristics (and principally the faster the hydration) because the surface area of the powder has increased.

Fast hydration is a goal of many of the industrial and commercial applications set forth above. In particular, in oilfield stimulation, the technique is to hydrate to full hydration as quickly as possible so as to waste as little product as possible. Rapid hydration also enhances fluid pumping performance.

In animal litter applications, rapid hydration allows the litter to clump faster and thereby makes for a better, more efficient product. For example, cat fluids do not drop to the bottom of the pan, they stay at the top.

In synthetic fuel applications, a better pellet or briquette results if the product is fully hydrated as it is dried. In explosives, the product is typically ruined if it takes on water when, for example, it is buried in the ground. If the product contains an agent that hydrates quickly, it seals the water from the explosive.

Reducing particle size to improve hydration is not always advantageous, however. Reducing particle size requires additional manufacturing costs in grinding and screening the product. It also creates additional fines which are hard to manage, package, and cause wasted product.

There is therefore a need in the industry to develop a guar gum powder whose hydration rate is increased while maintaining optimum particle size.

Hydration rate is not the only characteristic of guar gum powder that is of interest to the industrial and commercial applications described above. Hydration acceleration rate is also important. If hydration cannot reach, say, 50% hydration fast enough, the guar powder may be unsuitable for the application, even though the overall hydration rate may be acceptable.

There is therefore also a need in the industry to develop a guar gum powder having both faster hydration and faster hydration acceleration rates.

Responsiveness of the hydration rate to lower temperatures is also important. Typically, the lower the ambient temperature, the slower the hydration acceleration rate, even when the absolute time for 100% full hydration is acceptable. For example, in oil fracturing fluids applications in cold places such as the Rockies, Alaska, Canada, Russia and Scandinavia, the use of guar gum powder may not always be optimal when the hydration acceleration rate is slowed by the cold.

There is therefore also a need in the industry to develop a guar gum powder whose hydration acceleration rate is not as adversely affected by low ambient temperatures.

SUMMARY OF THE INVENTION

These and other objects, features and technical advantages are achieved by a method in which the manufacture of guar gum powder includes the step of extruding the hydrated splits prior to drying. The extruding step may be included before or after the step of flaking the splits.

The inclusion of the step of extruding the hydrated splits in the manufacturing process has been found to create a guar gum powder product which has advantageous properties over the prior art. These advantageous properties include (1) increasing the hydration rate and hydration acceleration rate of the guar gum powder without any corresponding change in particle size, and (2) providing a hydration acceleration rate that is less affected by cold temperatures.

Extrusion is known to be a part of the manufacturing process of products from other crops such as wheat or corn. Where extrusion is used in such processes, however, its purpose is known to be for objectives totally unrelated to improving hydration characteristics of the product. Generally its purpose is to shape the product into a desired physical profile.

It is therefore a technical advantage of the present invention to provide a process of making guar gum powder that hydrates faster and whose hydration accelerates faster, than prior art powders of corresponding particle size. The potential benefits of such a product to industrial and commercial applications are described in detail in the "background" section of this disclosure.

A further technical advantage of the present invention is that the inventive process provides a guar gum powder product whose hydration acceleration rate is less affected by cold temperatures. The potential benefits of such a product in cold environments are also described in detail in the "background" section.

A yet further technical advantage of the present invention is that the resulting guar gum powder product has numerous applications as a high-performance hydrating or thickening agent when mixed, integrated or suspended with host products. These products include, in addition to the ones discussed in the "background" section of this disclosure:

shampoo, body wash, lotions and other personal care products;
household cleaner;
catalytic converter catalyst;
electroplating solutions;
diapers and sanitary towels;
super-adsorbents in food packaging;
sticking plasters for skin abrasions ("band-aids");
water-adsorbing bandages;
foliar spray for plant leaves;
suspension for spraying plant seeds or nutrients; and
flotation aid or flocculent in particulate separation or water treatment processes.

The foregoing has outlined rather broadly the features and technical advantages of the present invention in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the invention will be described hereinafter which form the subject of the claims of the invention. It should be appreciated by those skilled in the art that the conception and the specific embodiment disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present invention. It should also be realized by those skilled in the art that such equivalent constructions do not depart from the spirit and scope of the invention as set forth in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

FIGURES 1 and 2 illustrate guar gum powder manufacturing processes known in the art;

FIGURES 3 and 4 illustrate alternative exemplary guar gum powder manufacturing processes according to the present invention;

FIGURE 5 illustrates the hydration performance at 70 degrees F of guar gum powder made according to a known process such as is illustrated in FIGURE 1;

FIGURE 6 illustrates the hydration performance at 40 degrees F of guar gum powder made according to a known process such as is illustrated in FIGURE 1;

FIGURE 7 illustrates the hydration performance at 70 degrees F of guar gum powder made according to the present invention; and

FIGURE 8 illustrates the hydration performance at 40 degrees F of guar gum powder made according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

FIGURES 1 and 2 illustrate processes known in the art to manufacture guar gum powder. These processes typically include hydrating guar gum splits as an initial step (101, 201). Popular techniques hydrate the splits to about a 20% - 80% moisture content. The hydrated splits may then be flaked using milling techniques or other flaking operations known in the art (102). Alternatively, the prior art is known to simply omit the flaking process, as seen on FIGURE 2. The splits then proceed to a grinding operation (103, 202) and a drying operation (104, 203) to yield a guar gum powder. This powder is then screened (105, 204), and then packaged for distribution (106, 205).

A manufactured powder particle size is generally selected by artisans in this field to optimize the hydration characteristics of the powder. Finer powder will generally produce a product that hydrates faster. However, finer powder also costs more to produce and is harder to handle. Also, finer powder is more susceptible to loss through waste.

FIGURES 3 and 4 illustrate alternative embodiments of the process of present invention. It will be seen that, by comparison to FIGURES 1 and 2, the inventive process in FIGURES 3 and 4 includes an extrusion step (302, 402). The extrusion step is advantageously carried out after hydration of the splits (301, 401) and before grinding (304, 404). According to the invention, however, the extrusion step (302, 402) may be performed either before or after flaking (303, 403).

Extrusion as shown in FIGURES 3 and 4 may be accomplished by using a single screw extruder or by other means known in the art.

Adding the extruding step according to the present invention has been found to improve the hydration characteristics of guar gum powder without affecting particle size. These improved characteristics include (1) increasing both the hydration rate and the hydration acceleration rate, and (2) providing a hydration acceleration rate that is less affected by cold temperatures.

The improved hydration characteristics of a guar gum powder made according to the inventive process are disclosed herein by example.

EXAMPLE 1

FIGURES 5 and 6 illustrate the hydration performance of guar gum powder made according to a known process as illustrated in FIGURE 1, whereas FIGURES 7 and 8

illustrate the corresponding hydration performance of guar gum powder made according to the inventive process as shown on FIGURE 4. It will be understood, however, that similar hydration performance to FIGURES 7 and 8 has been achieved according to the process of FIGURE 3, in which extrusion step 302 precedes flaking step 303 instead of following it.

Specifically, the samples whose hydration performance is shown on FIGURES 5, 6, 7 and 8 were made as follows. Guar gum splits from the same batch were hydrated to about a 20 - 80% moisture content at about 80 - 200 degrees F. The splits were then converted to flakes using a Farrell-Ross flaker. About half of the flaked splits were then extruded through a Bonnot Corporation extrusion machine having a 2" - 8" barrel diameter. The other half of the flaked splits were not extruded. All splits were then ground to a powder, dried to about a 1 - 10% moisture content, and then screened so that the entire powder sample passed through a 100 mesh sieve.

The comparative rates of hydration of the samples were then measured and plotted as set forth on FIGURES 5, 6, 7 and 8. On FIGURES 5 and 7, the comparative hydration performance of the samples at 70 degrees F is shown. On FIGURES 6 and 8, the comparative hydration performance of the samples at 40 degrees F is shown.

FIGURE 7, when compared to FIGURE 5, shows that the hydration rate at 70 degrees F is appreciably faster for the guar gum powder made according to the inventive process with the extrusion on step. For example, the sample in FIGURE 7 is over 90% hydrated after 5 minutes, whereas the sample in FIGURE 5 does not achieve 90% hydration until about 20 minutes. Further, it will be seen that the hydration acceleration rate of the sample in FIGURE 7 is appreciably faster than in the sample of FIGURE 5.

Moreover, FIGURE 8, when compared to FIGURE 6, shows that the hydration acceleration rate of the sample made according to the inventive process is less affected by lower temperatures. For example, the inventive sample in FIGURE 8 is at least 50% hydrated after about 90 seconds at 40 degrees F, and about 90% hydrated after 5 minutes. This is in comparison to FIGURE 7, illustrating the hydration performance of the same inventive sample at 70 degrees F, in which 50% hydration occurred at about 60 seconds and 90% hydration occurred after about 5 minutes. Thus, 50% hydration occurred only

30 seconds later in the inventive sample when hydrated at 30 degrees F lower temperature.

In contrast, the prior art sample in FIGURE 6 achieves 50% hydration at 40 degrees F after about 3 minutes, and achieves 90% hydration after about 20 minutes. This is in comparison to FIGURE 5, illustrating the hydration performance of the same prior art sample at 70 degrees F, in which 50% hydration occurred after about 90 seconds, and 90% hydration occurred after about 20 minutes. Therefore, 50% hydration occurred 90 seconds later in the prior art sample when hydrated at 30 degrees F lower temperature.

The foregoing disclosure relates to a process of manufacturing guar gum powder with improved hydration characteristics. As noted above, the polymer of interest in guar gum is polyglactomannan, a polysaccharide. It will be understood that the improved hydration characteristics of guar gum powder are likely to be exhibited by other polymers found in plant seed endosperms, including other polysaccharide-like polymers, when manufactured in powder form according to the inventive process.

It is also known in the art to chemically modify guar gum to achieve other characteristics. For example, it is known to add hydroxypropyl group polymers or carbonymethyl group polymers to the hydrated splits to enhance the achievable final viscosity of the guar gum powder. It will be understood that chemically modified hydrated guar splits are also likely to exhibit improved hydration characteristics when manufactured in powder form according to the inventive process.

It is also known in the art to genetically modify plants so as to achieve desired characteristics. For example, it is known to genetically modify guar gum seeds to alter the plant's climatic requirements so that the crop may be grown in a wider geographic territory. In the case of genetic modification of guar to alter the active polymer provided by the endosperm, it will be understood that powder from the endosperms of such genetically modified guar is also likely to exhibit improved hydration characteristics when manufactured according to the inventive process.

It will be further understood that minimal experimentation would be required by those of skill in this art to identify other plant seed endosperms (whether unmodified, chemically modified or genetically modified) that exhibit improved hydration characteristics when manufactured according to the inventive process. It will be

appreciated that once set up, a manufacturing process built according to the invention can easily process many types of plant seed endosperms with minimal modification, if any. Further, hydration performance of the powder product can be easily measured using well-known testing techniques.

Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims.

CLAIMS

We claim:

1. A method of manufacturing a powder having improved hydration characteristics, the method comprising the steps of:

(a) hydrating guar gum splits;

(b) processing the hydrated splits, said processing step including the substeps, in either order, of flaking the splits and extruding the splits;

(c) grinding said processed splits into a powder; and

(d) drying the powder.

2. The method of claim 1, in which the guar gum splits comprise polygalactomannan.

3. The method of claim 1, in which the guar gum splits have been chemically modified.

4. The method of claim 1, in which the guar gum splits have been genetically modified.

5. The method of claim 1, further including the step of screening the powder after drying.

6. The method of claim 1, in which:

the splits are hydrated in step (a) to about a 20% - 80% moisture content at about 80 - 200 degrees F;

the hydrated splits are extruded in step (b) through a 2" - 8" diameter barrel; and

the powder is dried in step (d) to a 1% - 10% moisture content.

7. The method of claim 6, in which said dried powder is then screened through a 100 mesh sieve.

8. The method of claim 1, in which the splits are hydrated in step (a) to about a 20% - 80% moisture content at about 80 - 200 degrees F.

9. The method of claim 1, in which the hydrated splits are extruded in step (b) through a 2" - 8" diameter barrel.

10. The method of claim 1, in which the powder is dried in step (d) to a 1% - 10% moisture content.

11. The method of claim 2, in which the powder is screened in said screening step through a 100 mesh sieve.

12. A guar gum powder product of the process comprising the steps of:

(a) hydrating guar gum splits;

(b) processing the hydrated splits, said processing step including the substeps, in either order, of flaking the splits and extruding the splits;

(c) grinding said processed splits into a powder; and

(d) drying the powder.

13. The guar gum powder product of claim 12, in which the guar gum splits comprise polygalactomannan.

14. The guar gum powder product of claim 12, in which the guar gum splits have been chemically modified.

15. The guar gum powder product of claim 12, in which the guar gum splits have been genetically modified.

16. The guar gum powder product of claim 12, in which said powder product hydrates faster than a corresponding powder made without said extruding substep in step (b).

17. The guar gum powder product of claim 12, in which said powder product has a hydration acceleration rate that is faster than a corresponding powder made without said extruding substep in step (b).

18. The guar gum powder product of claim 12, in which said powder product has a hydration acceleration rate that is slowed down less by lower temperature than a corresponding powder made without said extruding substep in step (b).

19. The guar gum powder product of claim 12, in which said powder product achieves about 90% hydration after about 5 minutes at about 70 degrees F.

20. The guar gum powder product of claim 12, in which said powder product achieves about 90% hydration after about 5 minutes at about 40 degrees F.

21. The guar gum powder product of claim 12, in which said powder product achieves about 50% hydration after about 60 seconds at about 70 degrees F.

22. The guar gum powder product of claim 12, in which said powder product achieves about 50% hydration after about 90 seconds at about 40 degrees F.

23. The guar gum powder product of claim 12, in which said powder product achieves about 90% hydration after about 5 minutes at about 70 degrees F and after about 5 minutes at about 40 degrees F, and in which said powder product further achieves about 50% hydration after about 60 seconds at about 70 degrees F and after about 90 seconds at about 40 degrees F.

24. The guar gum powder product of claim 12, in which:

the splits are hydrated in step (a) to about a 20% - 80% moisture content at about 80 - 200 degrees F;

the hydrated splits are extruded in step (b) through a 2" - 8" diameter barrel; and

the powder is first dried in step (d) to a 1% - 10% moisture content and then screened through a 100 mesh sieve.

25. The guar gum powder product of claim 23, in which:

the splits are hydrated in step (a) to about a 20% - 80% moisture content at about 80 - 200 degrees F;

the hydrated splits are extruded in step (b) through a 2" - 8" diameter barrel; and

the powder is first dried in step (d) to a 1% - 10% moisture content and then screened through a 100 mesh sieve.

26. The guar gum powder product of claim 12, in which said powder product is an agent in a host product selected from the group consisting of:

(a) drilling fluid;

(b) fracturing fluid;

(c) animal litter;

(d) explosive;

(e) foodstuff;

(f) paperstock;

(g) floor covering;

(h) synthetic fuel briquettes;

(i) water thickener for firefighting;

(j) shampoo;

(k) personal care lotion;

(l) household cleaner;

(m) catalytic converter catalyst;

(n) electroplating solution;

(o) diapers;

(p) sanitary towels;

(q) super-adsorbent in food packaging;

(r) sticking plasters for skin abrasions;

(s) water-adsorbing bandages;

(t) foliar spray for plants;

(u) suspension for spraying plant seeds;

(v) suspension for spraying plant nutrients;

(w) flotation aid; and

(x) flocculent.

27. A method of manufacturing a thickening agent for fluids, the method comprising the steps of:

(a) hydrating plant seed endosperms that contain a polymer having fluid thickening properties;

(b) processing the hydrated endosperms, said processing step including the substeps, in either order, of flaking the endosperms and extruding the endosperms;

(c) grinding said processed endosperms into a powder; and

(d) drying the powder.

28. The method of claim 27, in which the plant seed endosperms are taken from guar plants.

29. The method of claim 27, in which said polymer is a polysaccharide.

30. The method of claim 27, in which said polymer is polygalactomannan.

31. The method of claim 27, in which the plant seed endosperms have been chemically modified.

32. The method of claim 27, in which the plant seed endosperms have been genetically modified.

33. The method of claim 27, in which said powder is an agent in a host product selected from the group consisting of:

(a) drilling fluid;

(b) fracturing fluid;

(c) animal litter;

(d) explosive;

(e) foodstuff;

(f) paperstock;

(g) floor covering;

(h) synthetic fuel briquettes;

(i) water thickener for firefighting;

(j) shampoo;

(k) personal care lotion;

(l) household cleaner;

(m) catalytic converter catalyst;

(n) electroplating solution;

(o) diapers;

(p) sanitary towels;

(q) super-adsorbent in food packaging;

(r) sticking plasters for skin abrasions;

(s) water-adsorbing bandages;

(t) foliar spray for plants;

(u) suspension for spraying plant seeds;

(v) suspension for spraying plant nutrients;

(w) flotation aid; and

(x) flocculent.

34. An improved method for manufacturing a fluid thickener in powder form wherein plant seed endosperms are hydrated, flaked, ground and dried, the endosperms containing a polymer having fluid thickening characteristics, the improvement comprising:

extruding the endosperms after hydrating but before grinding, said extruding performed either before or after the endosperms are flaked.

35. The improvement of claim 34, in which the plant seed endosperms are taken from guar plants.

36. The improvement of claim 34, in which said polymer is a polysaccharide.

37. The improvement of claim 34, in which said polymer is polygalactomannan.

38. The improvement of claim 34, in which the plant seed endosperms have been chemically modified.

39. The improvement of claim 34, in which the plant seed endosperms have been genetically modified.

40. The improvement of claim 34, in which said fluid thickener in powder form is an agent in a host product selected from the group consisting of:

(a) drilling fluid;
(b) fracturing fluid;
(c) animal litter;
(d) explosive;
(e) foodstuff;
(f) paperstock;
(g) floor covering;
(h) synthetic fuel briquettes;

(i) water thickener for firefighting;

(j) shampoo;

(k) personal care lotion;

(l) household cleaner;

(m) catalytic converter catalyst;

(n) electroplating solution;

(o) diapers;

(p) sanitary towels;

(q) super-adsorbent in food packaging;

(r) sticking plasters for skin abrasions;

(s) water-adsorbing bandages;

(t) foliar spray for plants;

(u) suspension for spraying plant seeds;

(v) suspension for spraying plant nutrients;

(w) flotation aid; and

(x) flocculent.

IMPROVED HYDRATION OF GUAR GUM POWDER

ABSTRACT OF THE DISCLOSURE

A method, and a product of such method, in which the manufacture of guar gum powder includes the additional step of extruding hydrated and flaked guar splits prior to grinding and drying. The extruding step may be included before or after the step of flaking the splits. The inclusion of the extruding step, along with the flaking step, has been found to create a guar gum powder product which has advantageous properties over the prior art. These advantageous properties include (1) increasing the hydration rate and the hydration acceleration rate of the guar gum powder without any corresponding change in particle size, and (2) providing a hydration acceleration rate that is less affected by cold temperatures.

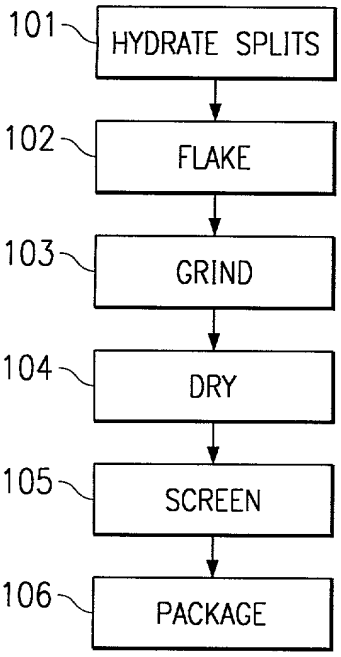

FIG. 1
(PRIOR ART)

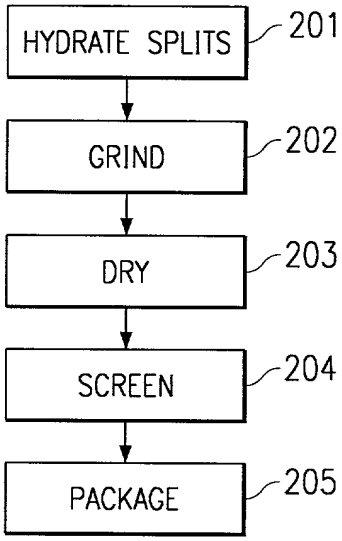

FIG. 2
(PRIOR ART)

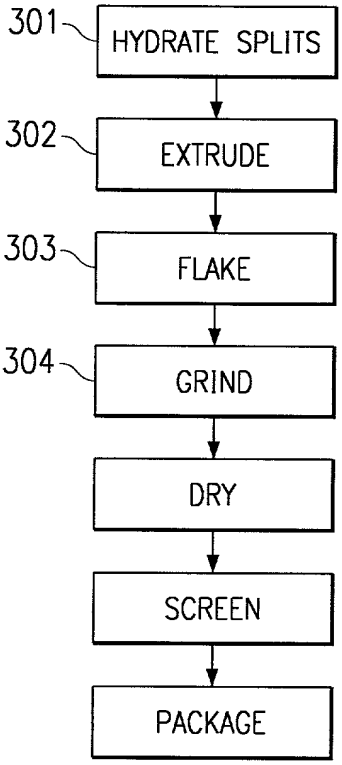

FIG. 3

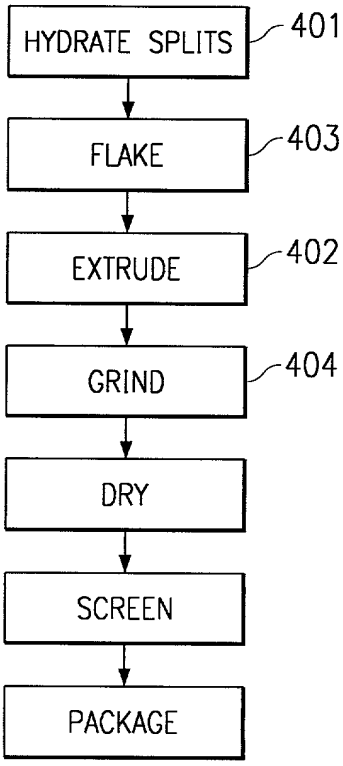

FIG. 4

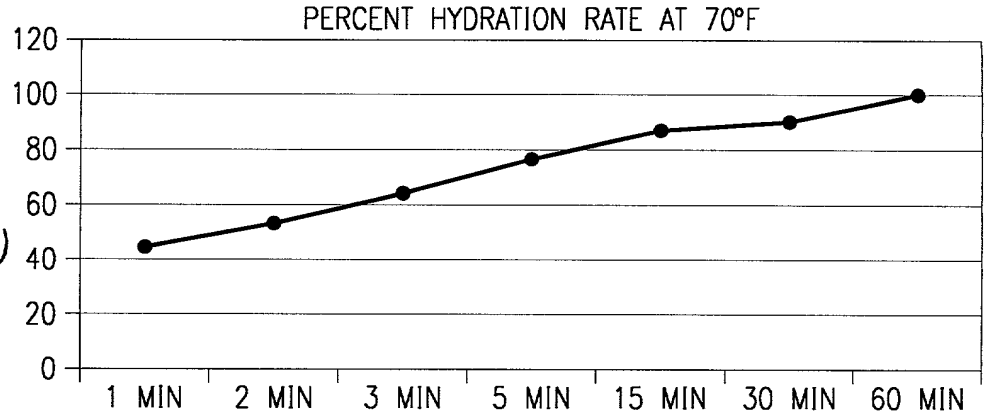

FIG. 5
(PRIOR ART)

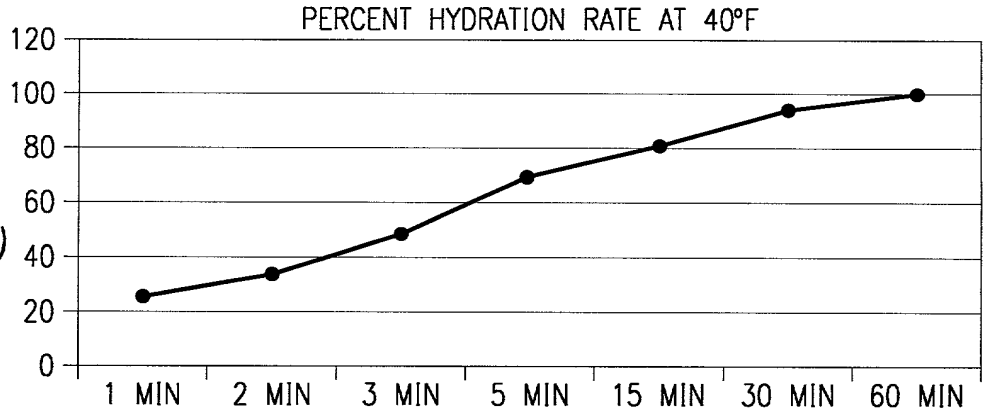

FIG. 6
(PRIOR ART)

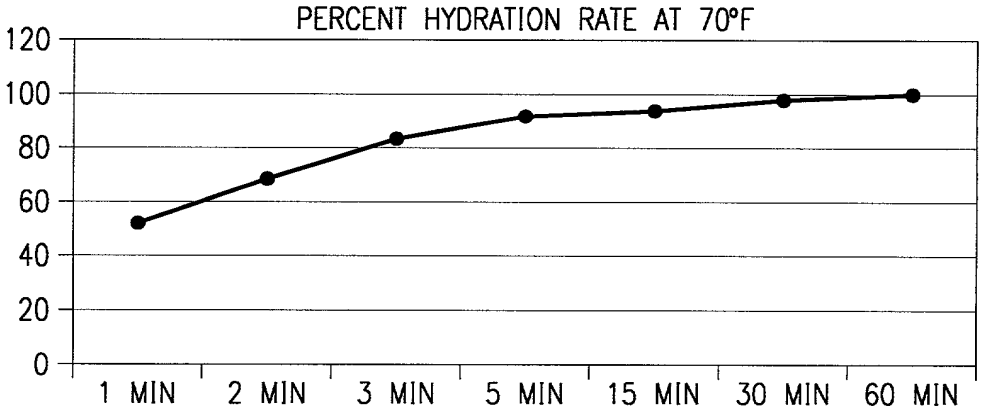

FIG. 7

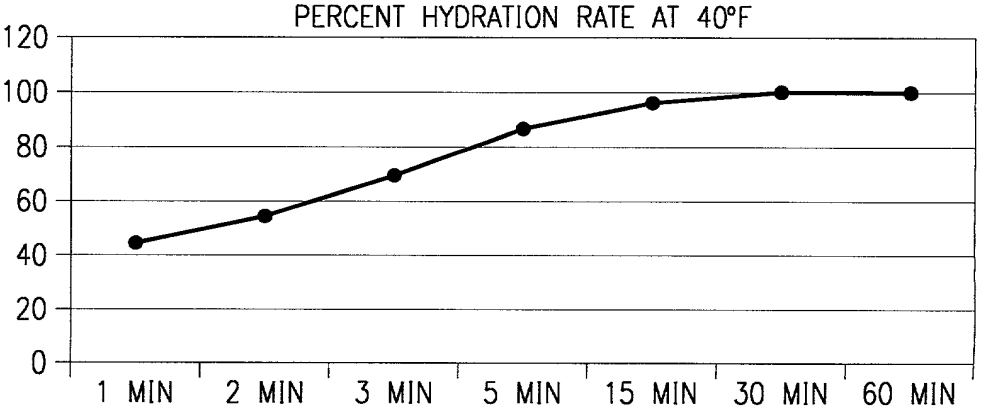

FIG. 8

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION, OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

- ☒ original.
- ☐ design.
- ☐ supplemental.
- ☐ national stage of PCT.
- ☐ divisional.
- ☐ continuation.
- ☐ continuation-in-part (C-I-P).

INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *(if plural names are listed below)* of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

IMPROVED HYDRATION OF GUAR GUM POWDER

SPECIFICATION IDENTIFICATION

The specification of which:

(a) ☒ is attached hereto.

(b) ☐ was filed on _____, as ☐ Serial No. 0 / _____ or ☐ _____ and was amended on _____ *(if applicable).*

(c) ☐ was described and claimed in PCT International Application No. _____ filed on _____ and as amended under PCT Article 19 on _____ *(if any).*

SUPPLEMENTAL DECLARATION (37 CFR 1.67(b))

☐ I hereby declare that the subject matter of the

☐ attached amendment

☐ amendment filed on _____.

was part of my/our invention and was invented before the filing date of the original application, above identified, for such invention.

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

☐ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 CFR 1.98.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(d) ☒ no such applications have been filed.

(e) ☐ such applications have been filed as follows.

PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING DAY, MONTH, YEAR	PRIORITY CLAIMED UNDER 35 USC 119
			[ ]YES [ ]NO
			[ ]YES [ ]NO

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(35 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER _____ /_____ **FILING DATE** _____

CLAIM FOR BENEFIT OF EARLIER U.S./PCT APPLICATION(S) UNDER 35 U.S.C. § 120

☐ I hereby claim the benefit, under Title 35, United States Code, § 120, of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application are not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information that is material to patentability as defined in 37, Code of Federal Regulations, §1.56, and that occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application. (37 C.F.R. § 1.63(e)).

APPLICATION SERIAL	FILING DATE	STATUS

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

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DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other document.

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